HSR Health Services Research

DOI: 10.1111/1475-6773.13016
RESEARCH ARTICLE

Hospital–Skilled Nursing Facility Collaboration: A Mixed-Methods Approach to Understanding the Effect of Linkage Strategies

Momotazur Rahman, Emily A. Gadbois, Denise A. Tyler, and Vincent Mor

Objective. To characterize the nature and degree of hospitals' efforts to collaborate with skilled nursing facilities (SNFs) and associated patient outcomes.

Data Sources/Study Setting. Qualitative data were collected through 138 interviews with staff in 16 hospitals and 25 SNFs in eight markets across the United States in 2015. Quantitative data include Medicare claims data for the 290,603 patients discharged from those 16 hospitals between 2008 and 2015.

Study Design/Data Collection. Semi-structured interviews with hospital and SNF staff were coded and used to classify hospitals' collaboration efforts with SNFs into high versus low collaboration hospitals, and risk-adjusted, claims-based hospital readmission rates from SNF were compared.

Principal Findings. Hospital collaboration efforts were defined as establishing SNF partners, transition management initiatives, and hospital staff visits to SNFs. High collaboration hospitals were more likely to send patients to SNFs (as opposed to home, home with home health, or other PAC settings), sent a higher share of patients to high quality SNFs, and had fewer hospital readmissions from SNF sooner than did low collaboration hospitals.

Conclusions. Although collaboration with SNF requires significant administrative and clinical time investment, it is associated with positive patient outcomes.

Key Words. Postacute care, hospital readmission, integration, interorganizational linkage

Each year nearly four million Medicare beneficiaries are discharged from hospitals to skilled nursing facilities (SNFs) for postacute care (PAC). About 20 percent of these patients are readmitted to a hospital within 30 days (Winblad et al. 2017). Although hospital and SNF stays involve two sets of healthcare providers and are reimbursed as two separate care episodes, policy changes

under the ACA, particularly the hospital readmission penalty, have altered the landscape to the point that hospitals must now consider the clinical capabilities of the settings to which they discharge their patients (Mor and Besdine 2011). Recent findings that admissions to hospital-based SNFs reduce the likelihood of hospital readmission (Rahman, Zinn, and Mor 2013; Rahman, Norton, and Grabowski 2016) suggest the importance of integration between hospitals and SNFs. Existing research has also documented the positive effect of hospital–SNF referral linkages. For example, hospitals with preferred SNF networks have reduced their readmission rate from SNF at a faster rate than those without such networks (McHugh et al. 2017). Similarly, patients that were discharged to SNFs that were more frequently utilized by the discharging hospital also experienced lower readmission rates (Rahman et al. 2013; Schoenfeld et al. 2016). While these studies point to the importance of collaboration between hospitals and SNFs, an important knowledge gap remains. Specifically, little is known about *how* hospitals collaborate with SNFs.

Our conceptual framework is based on structural contingency theory, a perspective that argues "there is no one best way to organize" and "any one way of organizing is not equally effective under all conditions" (Galbraith 1973). From this perspective, optimal organization is viewed as a function of the fit between the entity's environment, strategy, and structure. Thus, strategy is determined within the specific opportunities and constraints posed by the external and internal environment. In the case of PAC integration, different types and intensity of environmental pressures stemming from market, technology, and competitive forces enter into consideration in assessing the optimal strategy in the form of organizational integration, patient care integration, or a combination of both.

Collaborative efforts between hospitals and SNFs may have several different dimensions including whether there is a formal agreement, if there are resource sharing arrangements, and the level of the organization at which the collaboration occurs. Additionally, if there is a collaborative effort, what type of SNFs do hospitals choose to collaborate with and do hospitals with higher collaborative efforts rely more on SNFs for PAC of their patients? This paper aims to "look under the hood" of hospital–SNF collaborative efforts and to

---

Address correspondence to Emily A. Gadbois, Ph.D., Center for Gerontology and Healthcare Research, Brown University, 121 S. Main St., Providence, 5 RI 02905; e-mail: emily_gadbois@brown.edu. Momotazur Rahman, Ph.D., and Vincent Mor, Ph.D., are with the Center for Gerontology and Healthcare Research, Brown University, Providence, RI. Denise A. Tyler, Ph.D., is with Aging, Disability & Long-Term Care, RTI International, Waltham, MA.

describe the association between investments in collaborative relationships and changes in performance viz. hospital readmission rates of patients discharged to SNF.

Understanding the nature and degree of hospitals' collaborative efforts with SNFs requires a rigorous qualitative examination of organizational processes. However, as we also wanted to associate organizational behavior with organizational performance, we applied a mixed-methods approach. We first assessed collaborative efforts of 16 hospitals in eight different markets through in-depth interviews. Based on these qualitative interviews, we identified hospitals which could be readily characterized as having low or high collaborative efforts. Then, using Medicare claims data from 2008 to 2015 for fee-for-service patients in these hospitals, we compared trends in the distribution of discharges to alternative PAC settings, the quality of SNFs chosen, and the 30-day hospital readmission rates between low and high collaborative effort hospitals.

METHODS

Qualitative Methods

This sequential qualitative–quantitative mixed-methods study relies on data from qualitative interviews in addition to quantitative analyses of Medicare claims. We used a multiple case study methodology that included site visits to eight US healthcare markets in 2015. These visits were part of a larger study examining the relationships among managed care organizations, hospitals, and SNFs through interviews with staff at these organizations. The eight markets were selected to ensure variation based on region of the country, Medicare Advantage penetration rates, county size, and the absence or presence of functioning accountable care organizations. In each market, we selected two hospitals: one with a lower readmission rate and one with a higher readmission rate, as well as three SNFs that received referrals from these hospitals (for further information about market and facility selection, see McHugh et al. 2017).

The study reported herein included interviews conducted with 138 staff at the 16 hospitals and 25 SNFs. At each hospital, we interviewed the chief medical officer, vice president of strategy, a hospitalist, and a discharge planner. At each SNF, we interviewed the administrator, director of nursing, and an admissions coordinator. The interview protocols were developed and pilot tested in a large northeastern city. Our interview

topics focused on hospital relationships with SNFs, including efforts to establish partnerships, initiatives to improve transitions, sharing of staff, efforts to reduce hospital readmissions, and hospital–SNF information exchange. With participants' consent, all interviews were audio-recorded and transcribed for analysis. Interviews took place in participants' offices and averaged 40 minutes in length. This study was approved by our university's institutional review board.

Interview transcripts were qualitatively coded to identify overarching patterns and themes across transcripts (Crabtree and Miller 1999; Padgett 2012). We first developed a preliminary coding scheme based on the questions asked in our interview guides and then modified and refined the scheme in an iterative fashion to add codes and refine code definitions. Additional codes resulted when unexpected material emerged from interviews (Weston et al. 2001). The resulting coding scheme reflected both *a priori* codes and areas of interest from the interview questions as well as unanticipated findings.

Qualitative investigators worked in rotating teams of two to first individually code transcripts line by line using the constant comparative method (Glaser 1965) and then reconcile coding decisions. The full team met biweekly to discuss emerging themes, track their prevalence across transcripts, and search for evidence to explain discrepant information and better understand the range of responses. A comprehensive audit trail was used to keep track of these themes and decisions related to codes and code definitions. All coded data were entered into NVivo. Additional details about the qualitative analysis are provided elsewhere (Tyler et al. 2017).

Information obtained during visits to these eight markets was used to generate a summary measure characterizing hospitals' efforts to collaborate. As part of the site visit protocol, we asked about hospitals' efforts to collaborate with SNFs. During the process of coding the qualitative data, we explicitly focused on these questions, and based upon responses, created a series of summary scores. One of these focused on hospital efforts to establish SNF partnerships (scored 0–4; 4 indicating the highest level of partnership), and another on initiatives to improve transitions to SNF (scored 0–4; 4 indicating the highest effort to improve hospital–SNF transitions). Another score focused on the extent to which hospital staff collaborated with SNF staff to meet or manage discharged patients' needs (dichotomous, 0 or 1, absence or presence of hospital staff at the SNF). Thus, qualitative data were used to create quantitative scores for each hospital to classify them in terms of their collaboration with SNFs. We constructed an overall hospital collaboration effort score ranging from 0 to 9, with 0

indicating virtually no effort to collaborate with SNFs and 9 indicating a very strong effort. The overall scores across the 16 hospitals varied the full range.

Quantitative Methods

Data. Data come from two individual-level data sets: Medicare Part A claims (for hospital and SNF care) and Medicare enrollment data. Hospital and SNF claims were obtained using standard analytic file (SAF) for 2007–2010 and the Medicare Provider and Analysis Review (MedPAR) files for 2011–2015. All Part A claims include dates of service and up to 25 diagnoses. The Medicare enrollment file identifies individuals enrolled in Medicare within a given year and includes demographic data, survival status, residential zip code, and program eligibility information for Parts A, B, and D, Medicare Advantage, and Medicaid. We used monthly SNF star rating data extracted from Nursing Home Compare for the relevant years of study (Data.Medicare.gov 2017). Additionally, we used several county characteristics from the Area Resource File (ARF).

Sample. Using claims data, we identified all Medicare fee-for-service beneficiaries who were discharged from the 16 study hospitals between 2008 and 2015. We focused on 88 Diagnosis Related Groups (DRGs) that had at least 1,000 discharges during the study years. We excluded individuals who had a SNF stay during the 12 months prior to their qualifying SNF admission to minimize the effect of patients' being discharged to facilities in which they were already residing. We also excluded patients who were under age 65 at the time of their SNF admission. Our final sample consisted of 290,603 Medicare fee-for-service beneficiaries. Among these discharges, 79,947 were admitted to 1,377 different SNFs.

Outcome Variables. We examined two patient-level outcomes: (1) quality (measured by star ratings) of SNFs to which patients were discharged, and (2) 30-day hospital readmission rates among patients discharged to SNF and to other PAC settings.

As the quality of SNFs is not distributed the same way (or randomly) across neighborhoods and such distribution can change over time, we needed to take the star rating of the available SNFs near each patient's home neighborhood (or the choice set of SNFs) in each respective year into account. Thus, we first identified the star rating of the SNF nearest to a patient's residential zip code in each year. We then created a binary outcome variable indicating

whether the patient was discharged to a SNF with a star rating at least as high as the rating of the nearest SNF to the patient's zip code. To assess hospital readmission, we used a binary outcome variable indicating presence of any unplanned hospital admission within 30 days of hospital discharge.

Explanatory Variables. Our main explanatory variable is the hospital collaboration effort score, derived from our qualitative interviews. We dichotomized this variable, classifying hospitals with scores greater than or equal to five (of nine) as high collaboration hospitals and those with scores below five as low collaboration. Establishing the cut point was iterative and based on score distribution and qualitative understanding of how hospitals described their actions viz. the three types of interaction and exchanges of interest (sharing of staff, efforts to establish partnerships, and initiatives to improve transitions). Of the 16 study hospitals, five were identified as high SNF collaboration hospitals. These hospitals treated about one-third (99,520) of the sample patients.

We obtained age, gender, race, dual eligibility status, and residential zip code from the Medicare enrollment file. We used two zip code-/year-level variables obtained from the aggregated enrollment file, including the proportion of Medicare beneficiaries enrolled in Medicare Advantage and the proportion of Medicare beneficiaries who were dually eligible for Medicare and Medicaid. Clinical variables obtained from the claims data included the DRG under which the patient was discharged, the Deyo (Deyo, Cherkin, and Ciol 1992) comorbidity index, hospital length of stay, an indicator of hospital admission through the emergency room, and an indicator for intensive care unit use during the stay. We also included three county-/year-level variables from ARF: per capita income, number of SNF beds per thousand population, and number of home health agencies per thousand population.

Statistical Methods. Comparison of outcomes or care choices between patients in high and low collaboration hospitals is likely to be influenced by the patient population a hospital is serving and is therefore not causal. Thus, we primarily focus on how outcomes of the two groups of hospitals changed over the eight years of the study period relative to their own starting point.

To assess the quality of SNFs chosen by high and low collaboration hospitals, we plotted the adjusted likelihood of entering a SNF at least as good as the one nearest to the patient's residence. We estimated a logit model of this binary outcome variable onto patient-level explanatory variables, county-level variables, DRG fixed effects, and interactions of year dummies and an indicator of high collaboration hospital. Based on this regression, we computed the adjusted

likelihood of the outcome (entering a SNF at least as good as the nearest onto patient's zip code), which are the marginal effects associated with the interaction between year dummies and high collaboration dummy. We plotted the adjusted fraction of patients discharged to a SNF with at least as high a rating as the nearest SNF by year for low and high collaboration hospitals.

To assess patients' hospital readmissions, we plotted the adjusted 30-day hospital readmission rate by year for low and high collaboration hospitals separately for those who were discharged to a SNF and those discharged to any other setting. We ran logit regressions with an indicator of 30-day readmission as the outcome variable onto patient- and market-level explanatory variables, hospital dummies and year dummies, separately for two types of hospitals and two types of PAC settings (SNF and other settings). We then computed the adjusted rates as the marginal effects associated with the year dummies. We plotted these adjusted 30-day hospital readmission rates by year for the two types of hospitals separately for the two PAC settings.

Comparing trends in adjusted hospital readmission rates between two types of hospitals is challenging because high and low collaboration hospitals can be intrinsically different in terms of patient pool and market characteristics. Additionally, the share of patients discharged to a SNF may be higher and increasing over time for high collaboration hospitals. We included hospital fixed effects to address the first concern based on the assumption that most differences between high and low collaboration hospitals in terms of patient pool and market characteristics are time invariant. Of note, the concentration of Medicare Advantage and dual eligible beneficiaries in a patient's residential zip code as well as the hospital's county characteristics capture some time-varying changes across the two types of hospitals. To address the second concern, we performed a propensity score matching analysis. Here we assumed patients in a given year and in a given PAC setting belong to an independent sample and compared outcomes of low and high collaboration hospitals within each sample using a propensity score matching approach. Thus, we estimated 16 (eight years times two PAC settings: SNF vs. others) separate logit models to estimate the propensity score of admission to a high collaboration hospital using all patient characteristics. Then, we plotted rates of 30-day hospital readmission with respect to the propensity score for patients admitted to the two types of hospitals by year separately for two types of settings.

All analyses were conducted using *Stata 15*. The primary data collection and merger with secondary claims data were approved by the university's institutional review board and Medicare data were made available to the investigators under DUA RSCH-2015-28211.

RESULTS

Qualitative Results

During qualitative analyses, it emerged that some hospitals made significant efforts to collaborate with SNFs, while others did not. We categorized these efforts into three categories: efforts to establish SNF partners, initiatives to improve transitions to SNF, and hospital staff at the SNF. Examples of successful and unsuccessful collaborators with regard to these categories appear below, and additional quotes appear in Table 1.

Effort Establishing SNF Partners. As expected, some hospitals sought to have strong relationships with SNFs to which they discharged patients. One hospital CMO described the way they formalized these relationships:

> There will be a formal agreement around things like shared resources, so instead of me having a liaison in a SNF and they have a liaison in a hospital, we're gonna share those resources, to the point where I'm gonna actually pay part of the salary of the individual that they have in the facility. We're gonna share the intake process. We're both on the same IT system. . . Those will be dollar savings in terms of resources for us. We're gonna be doing the same thing around education. We have labs here-they're going to utilize our lab services, so those are all gonna be very, very formal in terms of how that will go into our contract. (Site 6, Hospital 2, Interview 1)

Conversely, a vice president of strategy at another hospital said:

> If there were necessity for an ad hoc meeting we wouldn't be opposed to that, but I know a lot of other health systems meet with people monthly, quarterly, or whatever it might be and go over data and talk about every single referral that they made. We almost went the opposite extreme; like, we have no interest in doing that, nor do we want to invest the dollars to do that because that's very labor intensive. It's going to be compete, your quality will speak for itself and we'll trust that you're managing and reviewing your patients and your data and that's your problem and you'll figure it out. (Site 4, Hospital 2, Interview 1)

Initiatives to Improve Transitions to SNF. Some hospitals made significant efforts to improve transitions to the SNF. One hospital director of extended care described their systems, which go beyond simply focusing on transitions and include the sharing of staff and developing official relationships with SNFs:

> Last year we felt that the there was some gaps in the transition of care. . . We had a rapid action work group to discuss those issues. So we had hospital partners, ourselves, the SNFs, work together on some of the action items. . . we have made sure that the hospitalists do provide timely discharge

Table 1: Additional Example Quotes

	Type of Collaborative Effort		
	Effort Establishing SNF Partners	*Initiatives to Improve Transitions to SNF*	*Hospital Staff at SNF*
Successful collaborators	We also have coordinators and those people are really the link between the hospital and the SNF. They go to all the team meetings at the SNF. They also have an operational meeting with each SNF on a monthly basis where they bring all of their outcomes as far as length of stay, home care capture, readmission. They do a clinical review of every case that's been readmitted. And then we. . . try to do a clinical education at least quarterly so that we can try to raise the caliber of the staff within the facilities (S4 H1 I1)	There's a transitions of care curriculum, so the residents are actually taught more in a formal way about transitions of care. This just started this past year. And my partner actually takes them out to the nursing homes and they spend some time with the resident care manager, the medical director, the social worker. They get a little more exposure early on to what happens to these patients when you send them to the nursing home (S5 H1 I2)	We try to make sure that that our physicians are able to provide quality care by being at the building, so we try to keep them focused on one or two buildings rather than having them drive to three or four buildings. So the old model where a physician would go to ten different buildings is gone (S1 H1 I2)
	Everybody wants to have a relationship with the hospital. They didn't realize that we wanted the relationship with them as well. . .The forum is actually a good, you know, talking about those important things that are quality driven and that really each facility has. . .their own footprint on (S2 H1 I3)	This facility every other month does a care transition forum where we invite in all postacute providers. And we do some type of presentation to them as well as lunch, and kinda get us to intermingle and get to know each other better (S2 H1 I1)	They continue to follow them here. They have a nurse practitioner that comes daily, a doctor that comes weekly. . . Ultimate goal, better care, reduce hospital readmissions, continuity of care. It's funded through the hospital. The doctor is on staff at the hospital, they're credentialed here as well (S8 N3 I1)
	One of the things was all around our quality measures and so we did create a scorecard. This is how we're gonna be showing it at every one of the quality meetings. We decided everything is going to be transparent. Their names will be at the bottom, showing exactly how they're performing and then, to be able to have a conversation. So if somebody is really performing well, we're going to want them to be able to present to other SNFs to say, here's what we've done, it worked really, really well and we'd be willing to share whatever (S3 H1 I1)	So at our last meeting we had asked the SNFs to please bring in their top five, we'll call 'em irritants, of things or defects that we pass onto them when we transition a patient over to their particular transitional care unit. I'm working with them and we wanted to do something from the hospital side and have a quick win for them to know that we are committed to this. And we have asked a lot of them and we want to show them that we're actually doing something (S3 H1 I1)	We work with [hospital] nurse practitioners and physicians that are here on site, which helps a lot because we have them here Monday through Friday. We don't get a lot of outside physicians. To me care is better if they see them when they need to see them. It could be every day and that's how we decrease the hospitalizations, I think (S3 N1 I1)

continued

Table 1. *Continued*

	Type of Collaborative Effort		
	Effort Establishing SNF Partners	*Initiatives to Improve Transitions to SNF*	*Hospital Staff at SNF*
Unsuccessful collaborators	Our system Clinical Outreach Officer put together a really good post acute continuum, where all of the skilled nursing facilities come and meet quarterly to go over the needs of the hospitals (S1 H2 I1)	We're having miscommunication with SNFs, so we're going to try now to have better communication, and we get to know which SNF they're going to, we're going to get the number of the physician who will be taking care of [the patient] after discharge, for us to call him quickly and give him summary about why we're discharging the patient, what's their condition, about what's happened, so that's hopefully going to happen in the coming two to three months (S2 H2 I3)	We're, yeah, we're moving in that direction. Yeah we already have some spattering of internists that kind of go out to nursing homes, but our goal is to formalize that into a true program with standardized templates, documentation, synchronized procedures (S4 H2 I1)
	Programs? Between us and nursing homes? I don't know if I'm aware of programs (S2 H2 I3)	I would say that this is still an area weakness within our organization. We do transitions out in the community but not within the nursing home (S6 H2 I1)	We used to have a SNFist program, we don't any longer (S5 H2 I2)
	The main form of communication is going to be emailing back to them if their performance hits the target, which they should already know, and then their performance for each metric against the average of the outfit who has submitted. So basically they will also know how well they're performing against their competition for each metric. Again, with the thought that competition drives performance. If most providers are doing exceedingly well with the target we'll just ratch up the target to drive performance (S4 H2 I1)	I mean it's mainly if someone's at higher risk we'll try to reach out as best we can to talk. . . I've made calls a couple of days later just to. . . because it took that long to figure out who was actually gonna see the person, so it's more like a patient to patient basis. Look out for this, look out for that, check this daily, you know, look at my discharge summary (S8 H1 I2)	Generally if they're Medicare-certified, it's fine. If we're hearing negative things from our patients. . . that's something we do talk to the facilities about. If at [facility], the patients are saying, "Oh, I don't want to ever go back there because of duh-duh-duh-duh-duh" or, "This was terrible" - we do call them. Because, if this were to hit the news it becomes. . . you wanna maintain credibility and advocate for the patient because the families will say, "Well, why are you telling us about [facility] when they've just had seven deaths and 16 falls, and 42 decubs." So it's a matter of when it's really good public knowledge. But if the patient still wanted to go there, that is their choice (S7 H2 I1)

> summaries, so there is another incentive program for them. And then we have placed our own computers in all the other partners' SNFs... There was a big IT expense for us, so we took that expense on... So now our physicians can go there and see the discharge summaries in the EHR. (Site 1, Hospital 1, Interview 2)

Other hospitals had put much less effort into such initiatives, with a hospitalist saying:

> I know we're talking with some SNFs to have better transitions with them, cause there's definitely a high population that will end up at a SNF, and so that's been another target, which is how do we transition that better. (Site 1, Hospital 2, Interview 3)

Hospital Staff at SNF. Some hospitals placed their staff members within SNFs in an effort to collaborate. A hospital staff member in charge of care integration described sharing staff with SNFs:

> The nine [SNFs] in our PAC network- our physicians and nurse practitioners are there three to five days a week. (Site 3, Hospital 1, Interview 3)

A discharge planner at another hospital stated that they wanted to move in that direction:

> It's actually something we're probably going to be doing down the line, but we haven't at this point. (Site 1, Hospital 2, Interview 4)

Quantitative Results

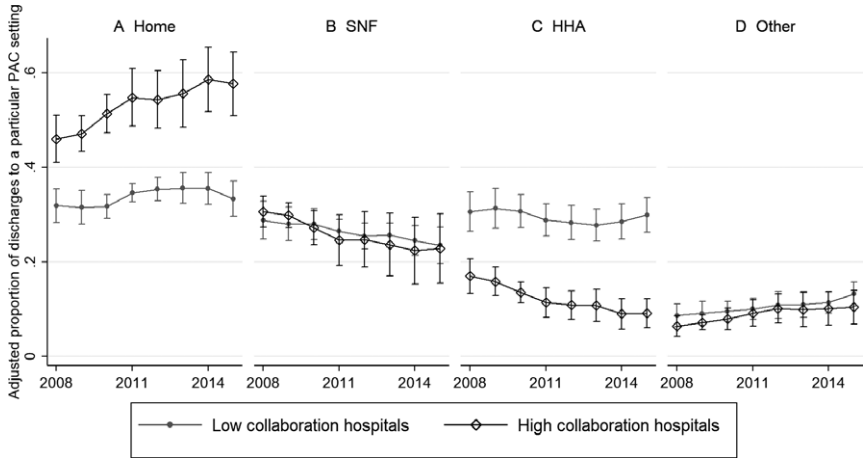
Table 2 presents characteristics of patients discharged from low and high collaboration hospitals in 2008 and 2015. The most important difference between high and low collaboration hospitals is that high collaboration hospitals served a much greater proportion of white and nondual eligible patients than did low collaboration facilities. In contrast to our expectations, high collaboration hospitals were in markets with a lower degree of MA penetration. High collaboration hospitals were also in markets with greater availability of nursing homes and home health agencies. These differences were persistent across years.

Before assessing outcomes experienced by patients discharged to different PAC settings, we first assessed the proportion of patients discharged to alternative PAC settings from high and low collaboration hospitals.

Table 2: Characteristics of Patients Discharged from Low and High Collaboration Hospitals

	Low Collaboration Score Hospitals		*High Collaboration Score Hospitals*	
Year	*2008*	*2015*	*2008*	*2015*
N	23,877	22,034	12,437	11,764
Patient characteristics				
Age	78.53	78.35	79.67	79.85
Female	58.7%	57.2%	57.2%	56.7%
Black	9.7%	10.3%	2.7%	2.8%
Other race	4.3%	5.7%	2.4%	3.7%
Dual eligible	14.1%	13.6%	6.0%	6.1%
Stay started through emergency room	67.8%	70.1%	70.7%	71.7%
Any ICU use	36.6%	19.0%	48.9%	21.5%
Hospital length of stay	5.63	4.90	4.68	4.28
Deyo comorbidity index	1.67	1.47	1.61	1.44
Patient's residential zip code characteristics				
% of MA in patient's residential zip code	0.224	0.278	0.142	0.183
% of dual eligible in patient's residential zip code	0.148	0.156	0.133	0.120
Hospital county characteristics				
Per capita income	48658	54270	49359	53988
Number of SNF beds per 1,000 population	4.56	4.09	6.61	6.39
Number of HHAs per 1,000 population	0.03	0.04	0.08	0.12
Outcomes				
30-day rehospitalization rates among SNF patients	16.8%	15.4%	16.1%	11.3%
30-day rehospitalization rates among patients discharged to other settings	13.4%	13.4%	13.4%	12.7%
% of patients discharged to a SNF which is at least as good as the nearest SNF	64.3%	61.7%	70.9%	77.6%

Figure 1: Adjusted Proportion of Patients Discharged to Alternative Postacute Care Settings

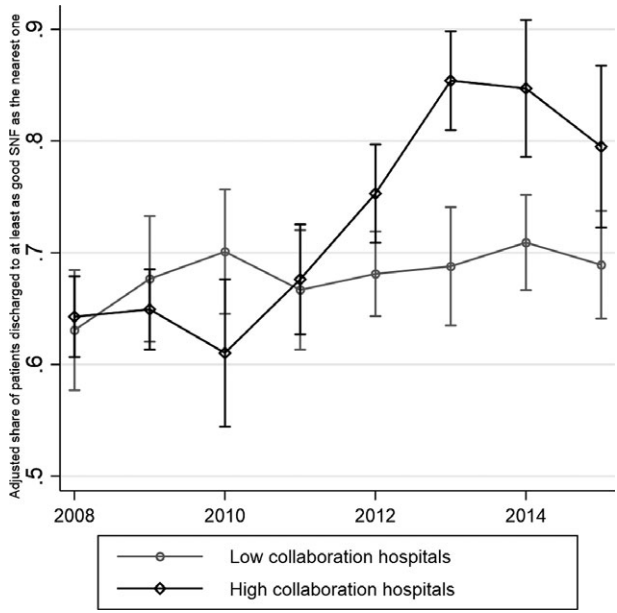


Note. To adjust for differences in patients between the hospitals, we plotted the share of patients discharged to alternative PAC settings, adjusted for patient- and county-level explanatory variables and DRG fixed effects. We first estimated a multinomial logit model with PAC setting as the outcome variable onto explanatory variables, DRG fixed effects, and interactions of year dummies and an indicator of whether or not the hospital was a high collaboration hospital. We then computed the adjusted likelihood of discharge to a PAC setting as the marginal effects associated with the interaction terms.

Figure 1 plots the share of patients discharged to alternative PAC settings adjusted for patient characteristics and the availability of different types of PAC providers listed in Table 2. The adjusted share of patients discharged to SNFs from both types of hospitals was 34 percent in 2008, and it declined at the same rate over time. The low collaboration hospitals sent a higher share of their patients home with home health care, and a lower share of patients home without any PAC. Of note, shares of discharges to different settings are likely explained by the different availability of PAC providers (as shown in Table 2). For example, in terms of the unadjusted rates, high collaboration hospitals sent a higher share of patients to SNFs (see Figure S1). However, such difference disappeared in terms of adjusted rates because of the high availability of PAC providers in the counties of high collaboration hospitals.

Figure 2 presents the proportion of patients discharged to a SNF which is at least as good (based upon the five-star rating system) as the nearest one to

Figure 2: Proportion of Patients Discharged to a SNF Which is at least as Good as the Nearest SNF

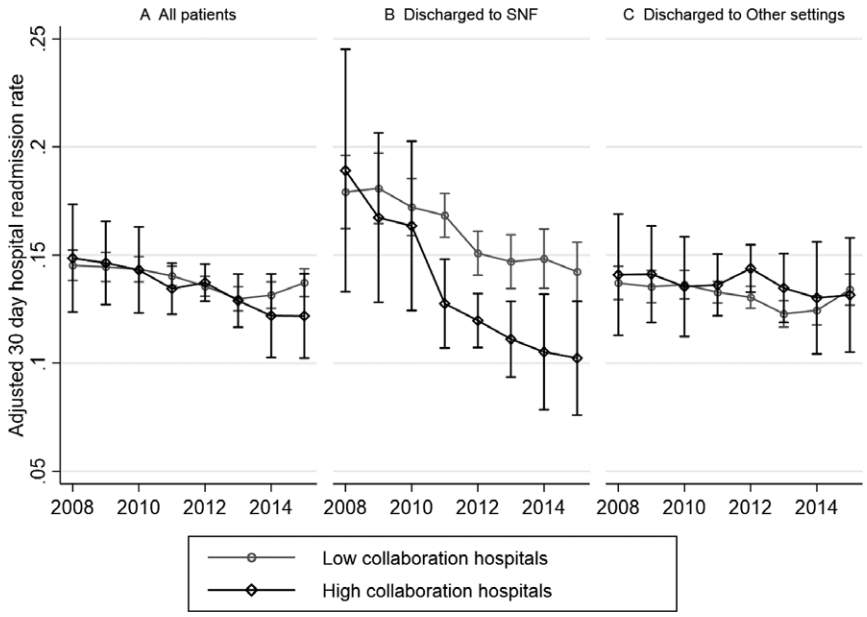


Note. Adjusted rates were calculated using a logit model controlling for patients socioeconomic characteristics, clinical characteristics from the index hospitalization claims, hospital county characteristics, and DRG fixed effects.

patients' residential zip codes, adjusting for all patient characteristics listed in Table 2 and DRG fixed effects. Before 2011, high collaboration hospitals sent a disproportionately smaller share of patients to SNFs with high star ratings. However, over time, high collaboration hospitals sent a higher share of patients to high star rating SNFs. See Figure S2 for a comparison of star rating of the nearest SNF from a patient's residential zip code for low versus high collaboration hospitals.

Figure 3 reveals trends in the adjusted 30-day hospital readmission rate among patients discharged to SNF and other settings from high and low collaboration hospitals. Both types of hospitals started with the same readmission rate from SNF in 2008 (~17 percent) among this population of patients without prior SNF exposure. However, high collaboration hospitals had lower readmission rates from SNF in 2015 compared to 2008, with a readmission rate of about 10 percent, whereas low collaboration hospitals had a readmission rate

Figure 3: Thirty-Day Hospital Readmission Rate among Patients Discharged to SNF from Low and High Collaboration Hospitals



Note. Each line of adjusted rates were calculated using a logit model controlling for patients socioeconomic characteristics, clinical characteristics from the index hospitalization claims, hospital county characteristics, DRG fixed effects, hospital fixed effects, and year dummies. Here, we plotted the marginal effects of the year dummies. Six lines are based on six separate regressions.

of about 14 percent in 2015. As can be seen in the second panel of Figure 3, the readmission rate from other PAC settings remained roughly the same over time for both types of hospitals.

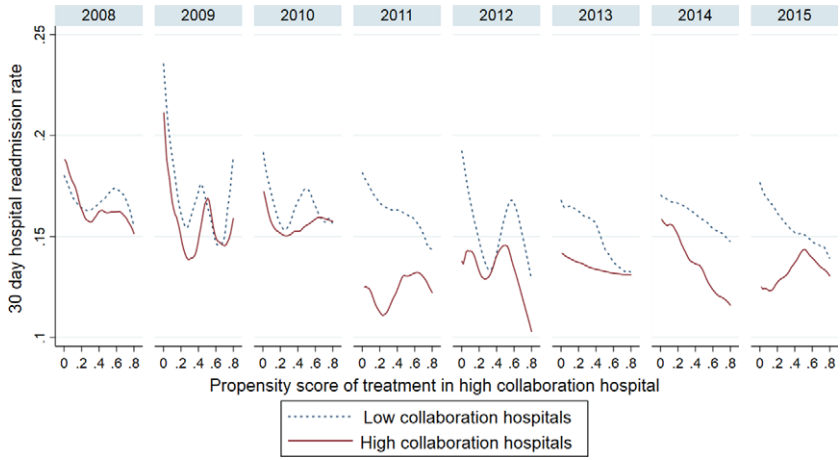
Figure 4 shows the polynomial smoothing plot of 30-day hospital readmission onto the propensity score of treatment in a high collaboration hospital separately for each year and each sample. The lines for high and low collaboration hospitals are mostly overlapping except for the later years (2011–2015) for patients who were discharged to SNF.

DISCUSSION

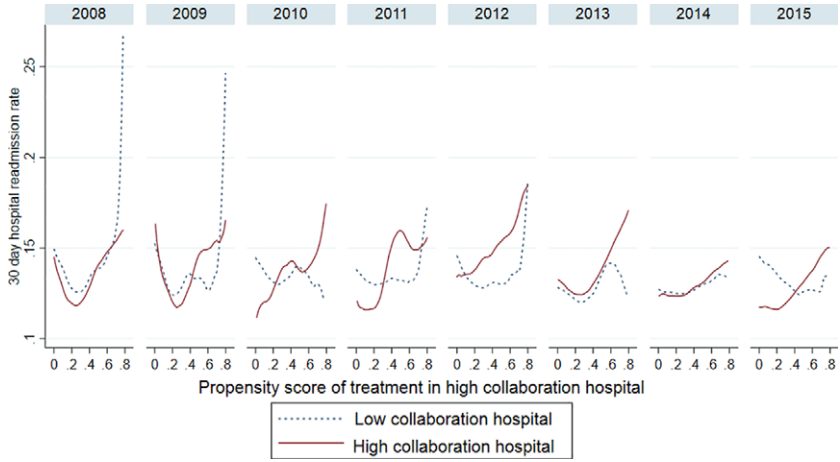
We undertook a sequential qualitative–quantitative mixed-methods study of hospital–SNF collaboration, including the associations among these

Figure 4: Comparison of 30-Day Hospital Readmission Rates between Patients from Low and High Collaboration Hospitals. (A) Patients Discharged to SNF. (B) Patients Discharged to Other Settings [Color figure can be viewed at wileyonlinelibrary.com]

Panel A



Panel B



Note. These are polynomial smoothing plots of 30-day hospital readmission with respect to propensity score of treatment in high collaboration hospital. For each year in each panel, we estimated propensity score separately.

collaborations and hospital referral patterns, the likelihood that patients are discharged to high star rating SNFs, and hospital readmission rates of patients discharged to SNF. Based upon site visits to 16 hospitals in eight markets and interviews with hospital staff and SNF leadership, we were able to characterize some of the hospitals as having invested in and worked to achieve a high degree of interorganizational linkage, while others evidenced very little collaborative effort. We found that collaborative relationships are associated with positive outcomes in terms of the likelihood that discharged patients are sent to better nursing homes and are less likely to be readmitted to the hospital.

Our interviews uncovered differences in hospital leadership's approach to relating to the SNFs to which patients were discharged. Collaboration consistently occurred at both the administrative and the clinical level. This is crucial as hospital and SNF leadership must authorize investment in collaboration, and both encourage and give permission for hospital clinicians to visit the SNF and treat patients there. There is a dearth of literature on the topic of hospital–SNF collaboration, so there are few examples of strategies used to enhance clinical information sharing, joint patient management, or even hospital staff supporting SNF-based clinicians. Only Colla and her colleagues have focused any attention on the role of PAC providers as possible partners in accountable care organizations, and they included limited data on the extent or types of connectivity (Colla et al. 2016; Lewis et al. 2017). There is much more literature on how hospitals align with physician groups that are not employed by the hospital (Lewis et al. 2017). Specifically, Huber and colleagues note that physician groups that are part of accountable care organizations are more likely to have transition management systems in place than are groups without such connections (Huber, Shortell, and Rodriguez 2017). On the other hand, Kerrissey and colleagues report that structural integration within a physician group practice may not be sufficient to enhance complex disease management, possibly indicating that more extensive collaboration between physicians and hospitals is necessary (Kerrissey et al. 2017).

High collaboration hospitals had prior relations with SNFs and expanded and enhanced those, with even more new SNF discharges and a smaller proportion of new PAC patients going to home health. It appears that hospitals' collaborative efforts began with their existing panel of SNF referral sources and then progressively referred more patients to the higher quality facilities among them, or those that were able to improve their quality as measured by CMS' five-star rating system. Prior research suggests that there is not a large change in the distribution of SNFs to which hospitals refer patients in general (Winblad et al. 2017), so we are likely observing a combination of

improving SNF quality among collaborating facilities as well as some disproportionate referral of patients that might previously have gone to poorer quality SNFs. Over the last decade, numerous quality improvement initiatives have been instituted in nursing facilities across the country with highly variable effects, but it may be that SNFs that are collaborating with hospitals are better able to implement these and have a stronger incentive to do so, precisely because of the collaborative partnership (CMS 2017).

The high collaboration hospitals are different from the low collaboration hospitals in several ways. The availability of PAC providers (both SNF and HHA) is higher for high collaboration hospitals. Similarly, quality of nearby SNFs measured in terms of star rating is also higher for high collaboration hospitals. Thus, high collaboration hospitals may have greater capacity to collaborate. Additionally, low collaboration hospitals served more poor and minority beneficiaries and were located in markets with lower availability of PAC providers. These can be a significant barrier for collaboration. Additionally, because of these factors, SNFs serving low collaboration hospitals may not be able to significantly change their practices even if there were collaborations between hospitals and SNFs.

While our finding that hospitals investing in collaborative relationships with SNFs have lower readmission rates is quite robust, we acknowledge that this is not a causal relationship, rather it is entirely descriptive. The high and low collaboration hospitals were different at the beginning of the study period and were located in different markets, both factors that may explain away the observed differences in patients' outcomes. However, the two groups began with very similar patient experiences and outcomes and it is the high collaboration facilities that had lower readmission rates far earlier than did the other hospitals. Our study included a large amount of data by the standards of qualitative research. Nonetheless, our results may not be generalizable. While we selected markets, hospitals, and SNFs to be generally representative, those hospitals, SNFs, and individuals who agreed to participate may be different from others who did not. However, the differences in how high and low collaboration hospitals functioned viz. partnering with nursing facilities was stark, suggesting that collaboration across our hospitals was much more of a presence or absence issue than a matter of degree. While future research should seek to more explicitly document how hospitals collaborate with all the SNFs to which they refer patients, we are confident that the large case mix adjusted differences in hospital readmission rates are real.

Another limitation of this paper is that we did not take time-variant hospital characteristics into account. This is partly because of low degrees of freedom: Our analysis is based on only 16 hospitals observed over 8 years. However, within-hospital change in characteristics may have driven some of our results. For example, there was ongoing hospital consolidation during the study period and high and low collaboration hospitals may have faced different levels of competition at different points of time. In response, we examined the potential effect of competition. Low collaboration hospitals faced a much lower level of competition than high collaboration hospitals (see Figure S3). However, this difference was roughly constant across all years and, as a result, hospital competition was not associated with hospital readmissions. Finally, our quantitative data only included fee-for-service Medicare beneficiaries. It may be that the MA population, particularly as it was more prevalent among the low collaboration hospital discharges, could alter the results.

In summary, we observe that hospitals which invested in collaborative relationships with SNFs experienced a steeper decline in hospital readmissions from SNF than was observed for hospitals which had not made such investments. The nature of collaborative investments was in the form of specific programmatic initiatives undertaken jointly with SNF partners such as shared staff, shared access to electronic health information, and joint activities such as sharing assessments and care planning. Such collaboration at the clinical level is greatly enhanced when hospital leadership reinforces the importance of such practices. While such collaborative partnerships may require effort to effectuate, our findings suggest that they are worthwhile when it comes to operational performance.

ACKNOWLEDGMENTS

Joint Acknowledgment/Disclosure Statement: This work was supported by the NIA (grant number P01 AG027296) and The Commonwealth Fund (grant number 20150004). Dr. Mor has three Significant Financial Interests (SFIs) that are broadly related to his area of research: HCR Manor Care Inc., NaviHealth, Inc., and Pointright, Inc. HCR Manor Care- Chair, Independent Quality Committee. NaviHealth- Chair of SAB, consultant. Pointright- former Director, holds less than 1 percent equity.

Disclosures: None.

Disclaimer: None.

REFERENCES

Colla, C. H., V. A. Lewis, S. L. Bergquist, and S. M. Shortell. 2016. "Accountability Across the Continuum: The Participation of Postacute Care Providers in Accountable Care Organizations." *Health Services Research* 51 (4): 1595–611.

Crabtree, B., and W. L. Miller (eds.). 1999. *Doing Qualitative Research*, 2d Edition. Thousand Oaks, CA: Sage.

Centers for Medicare and Medicaid Services. 2017. "Initiative to Reduce Avoidable Hospitalizations among Nursing Facility Residents" [accessed November 6, 2017]. Available at https://innovation.cms.gov/initiatives/rahnfr/

Data.Medicare.gov. 2017. "Nursing Home Compare Datasets" [accessed on November 15, 2017]. Available at https://data.medicare.gov/data/nursing-home-compare

Deyo, R. A., D. C. Cherkin, and M. A. Ciol. 1992. "Adapting a Clinical Comorbidity Index for use with ICD-9-CM Administrative Databases." *Journal of Clinical Epidemiology* 45 (6): 613–9.

Galbraith, J. R. 1973. *Designing Complex Organizations.* Boston, MA: Addison-Wesley Longman Publishing Co., Inc.

Glaser, B. G. 1965. "The Constant Comparative Method of Qualitative Analysis." *Social Problems* 12 (4): 436–45.

Huber, T. P., S. M. Shortell, and H. P. Rodriguez. 2017. "Improving Care Transitions Management: Examining the Role of Accountable Care Organization Participation and Expanded Electronic Health Record Functionality." *Health Services Research* 52 (4): 1494–510.

Kerrissey, M. J., J. R. Clark, M. W. Friedberg, W. Jiang, A. K. Fryer, M. Frean, S. M. Shortell, P. P. Ramsay, L. P. Casalino, and S. J. Singer. 2017. "Medical Group Structural Integration May Not Ensure that Care Is Integrated, from the Patient's Perspective." *Health Affairs* 36 (5): 885–92.

Lewis, V. A., K. I. Tierney, C. H. Colla, and S. M. Shortell. 2017. "The New Frontier of Strategic Alliances in Health Care: New Partnerships under Accountable Care Organizations." *Social Science & Medicine* 190 (Supplement C): 1–10.

McHugh, J. P., A. Foster, V. Mor, R. R. Shield, A. N. Trivedi, T. Wetle, J. S. Zinn, and D. A. Tyler. 2017. "Reducing Hospital Readmissions through Preferred Networks of Skilled Nursing Facilities." *Health Affairs* 36 (9): 1591–8.

Mor, V., and R. W. Besdine. 2011. "Policy Options to Improve Discharge Planning and Reduce Rehospitalization." *Journal of the American Medical Association* 305 (3): 302–3.

Padgett, D. 2012. *Qualitative and Mixed Methods in Public Health.* Thousand Oaks, CA: Sage.

Rahman, M., J. S. Zinn, and V. Mor. 2013. "The Impact of Hospital-Based Skilled Nursing Facility Closures on Rehospitalizations." *Health Services Research* 48 (2 pt1): 499–518.

Rahman, M., E. C. Norton, and D. C. Grabowski. 2016. "Do Hospital-Owned Skilled Nursing Facilities Provide Better Post-Acute Care Quality?" *Journal of Health Economics* 50: 36–46.

Rahman, M., A. D. Foster, D. C. Grabowski, J. S. Zinn, and V. Mor. 2013. "Effect of Hospital–SNF Referral Linkages on Rehospitalization." *Health Services Research* 48 (6 pt1): 1898–919.

Schoenfeld, A. J., X. Zhang, D. C. Grabowski, V. Mor, J. S. Weissman, and M. Rahman. 2016. "Hospital-Skilled Nursing Facility Referral Linkage Reduces Readmission Rates among Medicare Patients Receiving Major Surgery." *Surgery* 159 (5): 1461–8.

Tyler, D. A., E. A. Gadbois, J. P. McHugh, R. R. Shield, and V. Mor. 2017. "Patients Are Not Given Quality-Of-Care Data about Skilled Nursing Facilities when Discharged from Hospitals." *Health Affairs (Millwood)* 36 (8): 1385–91.

Weston, C., T. Gandell, J. Beauchamp, L. McAlpine, C. Wiseman, and C. Beauchamp. 2001. "Analyzing Interview Data: The Development and Evolution of a Coding System." *Qualitative Sociology* 24 (3): 381–400.

Winblad, U., V. Mor, J. P. McHugh, and M. Rahman. 2017. "ACO-Affiliated Hospitals Reduced Rehospitalizations from Skilled Nursing Facilities Faster than Other Hospitals." *Health Affairs* 36 (1): 67–73.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix SA1: Author Matrix.

Figure S1. Proportion of Patients Discharged to Alternative Post-Acute Care Settings.

Figure S2. Star Rating of the Nearest SNF from Patient's Residential Zip Code.

Figure S3. Hospital Competition Faced by Low and High Collaboration Hospitals.